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(54) Title: USE OF AMINE OXIDE SURFACTANTS FOR IMPROVED STAIN REMOVAL PERFORMANCE (57) Abstract The present invention relates to the use of an amine oxide surfactant according to the formula R ₁ R ₂ R ₃ NO, wherein each of R ₁ , R ₂ and R ₃ is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, or mixtures thereof, in a cleaning composition, to improve the stain removal performance of said composition. The present invention further relates to processes of cleaning carpets and of pretreating fabrics with said compositions.		

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USE OF AMINE OXIDE SURFACTANTS FOR IMPROVED STAIN REMOVAL PERFORMANCE

Technical Field

The present invention relates to the use of amine oxide surfactants in cleaning compositions and more particularly to their ability to remove stains, soils or combinations thereof from carpets and fabrics.

Background of the Invention

Carpets produced from synthetic or natural fibers and mixtures thereof are commonly used in residential and commercial applications as a floor covering. Various types of fibers can be used in making carpets such as polyamide fibers, polyester fibers as well as wool, cotton or even silk.

However, carpets as well as fabrics, irrespective of whether they are made from natural or synthetic fibers, are all prone to soiling and staining when contacted with many household items. Foods, grease, oils, beverages in particular such as coffee, tea and soft drinks especially those containing acidic dyes can cause unsightly, often dark stains on carpets and fabrics.

Also carpet fibers may become soiled as a result of dirt particles, clay, dust, particulate soils in general, coming into contact with and adhering to the fibers of the carpets. These latter soils often appear in the form of a diffuse layer of soils rather than in the form of spots and tend to accumulate particularly in the so called "high traffic areas" such as near doors as a result of intensive use of the carpets in such areas.

There are a number of carpet cleaning compositions described in the art for removing stains and soils from carpets as well as a number of fabric cleaning compositions described in the art for removing stains and soils from fabrics. However, these compositions do not satisfactorily meet the consumer's needs regarding their cleaning performance on different types of stains and soils. For example, carpet cleaning compositions are not fully

satisfactory on removing particulate stains and/or greasy stains, especially in the so called "high traffic areas" of carpets.

Thus the object of the present invention is to provide improved stain removal performance, in a manner which is applicable to a variety of cleaning compositions, i.e. compositions being either in a liquid form, or in a powder form, or in a granular form, and to a variety of applications like carpets and/or fabrics cleaning applications.

It has now been found that the above object can be met by incorporating amine oxide surfactants according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, in a cleaning composition. Indeed, it has now been found that said amine oxide surfactants allow to deliver improved stain removal performance on a variety of stains including particulate stains, greasy/oily stains like chocolate, spaghetti sauce, mayonnaise as well as bleachable stains like coffee, tea, and enzymatic stains like blood. The present finding is applicable both in laundry cleaning application, especially in laundry pretreatment, and in carpet cleaning application.

An advantage of the present invention is that it is applicable to all carpet types, especially delicate natural fibers and is also safe to all carpet dye types, particularly sensitive natural dyes used therein. The present invention is particularly suitable for the cleaning of upholstery and car seat coverings.

Another advantage is that the compositions to be used according to the present invention may be applied directly on the carpet without causing damage to the carpet. In addition the cleaning action of the invention commences as soon as the carpet cleaning composition has been applied to the surface. Indeed, the use of the carpet cleaning compositions of the present invention does not necessarily require rubbing and/or brushing of the carpet.

A further advantage of the present invention is that it is applicable to all types of fabrics, especially delicate fabrics upon pretreatment conditions, e.g., when applied onto the fabrics even for a prolonged period of contact, before said fabrics are washed.

Summary of the Invention

The present invention encompasses the use of an amine oxide surfactant according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, in a cleaning composition, to improve the stain removal performance of said composition.

The present invention further encompasses a method of cleaning a carpet wherein a composition comprising an amine oxide surfactant according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, is applied to said carpet, wherein said carpet is then optionally rubbed and/or brushed, and wherein said composition is then removed from said carpet.

The present invention also encompasses a method of pretreating fabrics with a composition comprising an amine oxide surfactant according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, said method comprising the steps of applying said composition in its neat form onto the fabric, and allowing said composition to remain in contact with said fabric before said fabric is washed.

All amounts, percentages and ratios are given by weight of the total composition in its neat form unless otherwise stated.

Detailed Description of the Invention

In its broadest aspect, the present invention relates to the use of amine oxide surfactants according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, in a cleaning composition to improve the stain removal performance of said composition.

As an essential ingredient, the compositions to be used according to the present invention comprise an amine oxide surfactant or mixtures thereof.

Suitable amine oxide surfactants to be used herein are according to the following formula $R_1R_2R_3NO$ wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl groups of from 1 to 30 carbon atoms, and preferably of from 1 to 20 carbon atoms. Particularly preferred amine oxide surfactants to be used according to the present invention are amine oxide surfactants having the following formula $R_1R_2R_3NO$ wherein R_1 is a saturated linear or branched alkyl group of 1 to 30 alkyl group, preferably of 6 to 18 alkyl group, more preferably of 6 to 14, most preferably of 6 to 10 and wherein R_2 and R_3 are independently substituted or unsubstituted, linear or branched alkyl groups of from 1 to 4 carbon atoms, preferably of from 1 to 3 carbon atoms, and more preferably are methyl groups. In the most preferred embodiment of the present invention said amine oxide surfactants are pure-cut amine oxide surfactants, i.e., a pure single amine oxide surfactant, e.g. C₈ N,N-dimethyl amine oxide, as opposed to mixtures of amine oxide surfactants of different chain lengths.

Suitable amine oxide surfactants for use herein are for instance pure cut C₈ amine oxide or pure cut C₁₀ amine oxide or pure cut C₁₄ amine oxide, natural blend C₈-C₁₀ amine oxides as well as C₁₂-C₁₆ amine oxides. Said amine oxide surfactants may be commercially available from Hoechst or Stephan.

Indeed, it has now been found that said amine oxide surfactants allow to deliver improved stain removal performance on a variety of stains/soils including particulate stains, greasy/oily stains, bleachable stains and/or enzymatic stains.

Indeed, it has been found that the removal of stains, in particular particulate stains and/or greasy/oily stains and/or bleachable stains and/or enzymatic stains achieved by using a cleaning composition comprising said amine oxide surfactants, is improved, as compared to the removal of stains obtained by using the same composition without said amine oxide surfactants or the same composition but with another surfactant like for instance alkyl sulphate instead of said amine oxide surfactants.

By "particulate stains" it is meant herein any soils or stains of particulate nature that can be found on carpets or fabrics, e.g., clay, dirt, dust, mud, concrete and the like.

By "greasy/oily stains" it is meant herein any soils or stains of greasy/oily nature that can be found on carpets or fabrics, e.g., make-up, lipstick, dirty motor oil and mineral oil, greasy food like mayonnaise and spaghetti sauce.

By "bleachable stains" it is meant herein any stains on carpets or fabrics that can be oxidised by bleach, e.g. coffee, tea, wine, grass or fruit juice.

By "enzymatic stains" it is meant herein any soils or stains of enzymatic nature that can be found on carpets or fabrics, e.g., blood.

Also in the preferred embodiment of the present invention wherein the compositions herein further comprise a source of active oxygen, the presence of said amine oxide surfactants improves the chemical stability of said compositions. Indeed, we have observed that improved chemical stability, i.e., lower decomposition of the bleach and the bleach activator, if present, is obtained by adding such an amine oxide surfactant. It is believed that such stability is due to the capacity of the amine-oxide surfactants to limit interactions between the bleach and the bleach activator, if present, possibly through emulsification. It is believed that this stabilising effect is matrix independent.

Furthermore, said amine oxide surfactants, especially pure-cut short chain (C6-C10) amine oxide surfactants have the advantage to reduce the amount of residues left onto fibers being treated with a composition comprising them. Also, the residues left after said composition comprising them has performed its cleaning action are partially in a crystalline form. Indeed, it has been observed that with the compositions according to the present invention comprising said amine oxide surfactants, especially pure-cut amine oxide surfactants, more than 90%, preferably more than 95%, of the residues left onto the fibers are crystals (generally lamellar and/or needle-shaped) with an average particle surface bigger than $300\mu^2$. This results in a process of cleaning carpets whereby the residues left onto the carpets are removed more easily as opposed to residues being sticky and thus difficult to remove by for example vacuum cleaning said carpets.

Another advantage of the presence of said amine oxide surfactants, for example mixtures of short chain amine oxide surfactants (C6-C10) with longer chain ones (e.g., C12-C30 amine oxide surfactants), in the compositions according to the present invention, is that they allow to control the foam level and especially the foam persistence in said compositions. This results in compositions being particularly suitable to be used in carpet cleaning machines as well as neat onto carpets and/or fabrics without formation of high amounts of foam.

Actually, an advantage of the finding of the present invention is that it is applicable in different cleaning processes including carpet cleaning and fabric cleaning especially fabric pretreatment.

Accordingly, such cleaning compositions comprising said amine oxide surfactants are particularly useful as laundry pretreaters, i.e. in a process where said composition is applied in neat form onto soiled portions of fabrics before said fabrics are washed in a separate, typical laundry operation. Preferably, said composition in neat form is left to act on said portions for a period of time before the fabrics are washed in said laundry operation. Preferably, said composition in neat form is not left to dry onto said portions. Preferably, said period of time is in between 1 minute to several hours, more preferably 1 minute to 1 hour, more preferably 1 minute to 30 minutes and most preferably 2 to 10 minutes. Optionally, when said fabrics are soiled with encrusted stains and soils, said pretreatment process may additionally involve rubbing and scrubbing. It has been observed that in such a pretreatment process, the presence of said amine oxide surfactants improves the stain removal performance on a variety of stains. It is believed that this improvement in stain removal performance is matrix independent.

Such cleaning compositions comprising said amine oxide surfactants are also particularly useful as carpet cleaning compositions. Accordingly, the present invention also encompasses a method of cleaning a carpet wherein a composition comprising an amine oxide surfactant according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, is applied to said carpet, wherein said carpet is

then optionally rubbed and/or brushed, and wherein said composition is then removed from said carpet.

Indeed, in the method of cleaning a carpet according to the present invention the step of applying a composition for the cleaning of carpets as described herein before, may be followed by a rubbing step and/or a brushing step. An advantage of the present invention is that the cleaning action of said compositions commences as soon as said compositions are applied onto said carpet. Thus, the cleaning process of the present invention does not necessarily require rubbing and/or brushing. It is only in the case of highly soiled carpets or in the so called "high traffic areas" that the carpet may be cleaned by applying onto it said composition for the cleaning of carpets according to the present invention, then rubbing and/or brushing it more or less intensively for example by means of a sponge or a brush or other mechanical/electrical device, optionally with the aid of water. In general, the rubbing/brushing-times are between 1 to a few minutes per square meter. After the composition for the cleaning of carpets according to the present invention has been applied onto the carpet and optionally rubbed and/or brushed, said composition is removed from said carpet, preferably by mechanical means including brushing out and/or vacuum cleaning.

The compositions for the cleaning of carpets according to the present invention may be applied to the carpet to be cleaned either in neat or diluted form, this applies to compositions being either liquid compositions or granular compositions or powder compositions.

By "diluted form" it is meant herein that the compositions for the cleaning of carpets according to the present invention may be diluted by the user, preferably with water. Said compositions can be diluted up to 150 times, preferably up to 50 times and more preferably up to 25 times.

In a preferred embodiment herein, the compositions for the cleaning of carpets according to the present invention are liquid aqueous compositions. Indeed, a liquid aqueous composition, i.e. an aqueous composition for the cleaning of carpets in its neat form or which has been diluted with water by the user or an aqueous composition resulting from the dilution of a granular composition or of a powder composition, is applied to the carpet to be

cleaned, said carpet is optionally rubbed and/or brushed, then said composition is left to dry and then removed from said carpet. Indeed, said liquid aqueous composition is left to dry until said composition which combined with dirt has been changed into dry residues. These residues are then removed from the carpet mechanically. Such liquid aqueous compositions may be applied directly onto the area to be treated or applied using a cloth or piece of material such as spraying device or aerosol can, a sponge, a brush or other mechanical/electrical device. In a preferred embodiment of the invention a liquid aqueous composition is applied to the area to be treated by using a spraying device or an aerosol can. Such a spraying device may be trigger operated or pump operated or electrically operated or operated by any source of pressurised gas such as a can or a pressurizer. Such spraying devices are particularly preferable if a large area is to be treated as it facilitates the ease of use for the consumer. The spraying devices ensure uniform coverage of the area to be treated and maximises the advantage of the using liquid aqueous compositions containing peroxides. This is because the application of product by spray best allows the product to be left to dry on the area treated, even without rubbing or brushing. This optimises the action time of the composition and allows the best exploitation of the bleaching action of peroxides.

In another embodiment, the compositions for the cleaning of carpets according to the present invention are granular compositions or powder compositions. Such compositions for the cleaning of carpets according to the present invention may be applied directly onto the area of the carpet to be treated by for example sprinkling said composition over said area or may be applied by using a sponge, a brush, or other mechanical/electrical device preferably in presence of water and then left to dry and then removed from said carpet.

The area to be treated using the compositions according to the present invention may be any size. In addition, a complete section or even a whole carpet may be applied with the composition for the cleaning of carpets according to the present invention. For such purposes when using a liquid aqueous composition a spraying device with a pump to allow prolonged spraying is particularly useful.

The amount of the compositions for the cleaning of carpets according to the present invention applied will depend on the severity of the stains or soils. In the case of stubborn stains more than one application may be required to ensure complete removal of the stain. The carpet cleaning compositions may also be used in order to deodorise the carpet and remove the dinginess of the carpet resulting from a diffused layer of soil which results from general wear.

The compositions for the cleaning of carpets according to the present invention may be used both for manual carpet cleaning and carpet cleaning machines. For carpet cleaning machines the compositions for the cleaning of carpets according to the present invention, i.e. either liquid compositions or granular compositions or powder compositions, may be preferably diluted according to the machine operating instructions.

The compositions suitable to be used according to the present invention may be formulated either as solids or liquids. In the case where the compositions are formulated as solids for example as granular compositions or powder compositions, they may be applied directly on the surfaces to be treated or they may be diluted with an appropriate solvent, typically water, before use. In liquid form, the compositions are preferably but not necessarily formulated as aqueous compositions. Liquid compositions are preferred herein for convenience of use.

The compositions according to the present invention may further comprise as an optional but highly preferred ingredient a source of active oxygen or mixtures thereof. In the preferred embodiment, said compositions are liquid aqueous compositions and have the advantage, due to the presence of said amine oxide surfactants, to be particularly efficient in terms of overall cleaning performance and to be chemically stable. Indeed, said liquid aqueous compositions according to the present invention do not require pH adjustment prior to use and can be stored for long periods of time prior to use.

A preferred source of active oxygen according to the present invention is hydrogen peroxide or sources thereof. As used herein a hydrogen peroxide source refers to any compound which produces hydrogen peroxide when said compound is in contact with water. Suitable water-soluble sources of

hydrogen peroxide for use herein include percarbonates, metal peroxides and perborates.

In addition other classes of peroxides can be used as an alternative to hydrogen peroxide and sources thereof or in combination with hydrogen peroxide and sources thereof. Suitable classes include dialkylperoxides, diacylperoxides, preformed percarboxylic acids, persilicates, persulphates, organic and inorganic peroxides.

Suitable organic and inorganic peroxides for use in the compositions according to the present invention include diacyl and dialkyl peroxides such as dibenzoyl peroxide, dilauroyl peroxide, dicumyl peroxide, persulphuric acid and mixtures thereof.

Suitable preformed peroxyacids for use in the compositions for the cleaning of carpets according to the present invention include diperoxydodecandioic acid DPDA, magnesium perphthalatic acid, perlauric acid, perbenzoic acid, diperoxyazelaic acid and mixtures thereof.

Accordingly, the compositions suitable to be used according to the present invention comprise from 0.1% to 15%, preferably from 0.5% to 10%, more preferably from 1% to 7% by weight of active oxygen in said compositions.

As used herein, active oxygen concentration refers to the percentage concentration of elemental oxygen, with an oxidation number zero, that being reduced to water would be stoichiometrically equivalent to a given percentage concentration of a given peroxide compound, when the peroxide functionality of the peroxide compound is completely reduced to oxides. The active oxygen sources according to the present invention increase the ability of the compositions to remove colored stains, to destroy malodorous molecules and to kill germs.

The concentration of available oxygen can be determined by methods known in the art, such as the iodimetric method, the permanganometric method and the cerimetric method. Said methods and the criteria for the choice of the appropriate method are described for example in "Hydrogen Peroxide", W. C. Schumb, C. N. Satterfield and R. L. Wentworth, Reinhold Publishing Corporation, New York, 1955 and "Organic Peroxides", Daniel Swern, Editor Wiley Int. Science, 1970.

The compositions suitable to be used according to the present invention may further comprise a bleach activator or mixtures thereof, as another optional ingredient. By "bleach activator", it is meant herein a compound which reacts with hydrogen peroxide to form a peracid. The peracid thus formed constitutes the activated bleach. Suitable bleach activators to be used herein include those belonging to the class of esters, amides, imides, or anhydrides. Examples of suitable compounds of this type are disclosed in British Patent GB 1 586 769 and GB 2 143 231 and a method for their formation into a prilled form is described in European Published Patent Application EP-A-62 523. Suitable examples of such compounds to be used herein are tetracetyl ethylene diamine (TAED), sodium 3,5,5 trimethyl hexanoyloxybenzene sulphonate, diperoxy dodecanoic acid as described for instance in US 4 818 425 and nonylamide of peroxyadipic acid as described for instance in US 4 259 201 and n-nonanoyloxybenzenesulphonate (NOBS). Also suitable are N-acyl caprolactam selected from the group consisting of substituted or unsubstituted benzoyl caprolactam, octanoyl caprolactam, nonanoyl caprolactam, hexanoyl caprolactam, decanoyl caprolactam, undecenoyl caprolactam, formyl caprolactam, acetyl caprolactam, propanoyl caprolactam, butanoyl caprolactam pentanoyl caprolactam or mixtures thereof. A particular family of bleach activators of interest was disclosed in EP 624 154, and particularly preferred in that family is acetyl triethyl citrate (ATC). Acetyl triethyl citrate has the advantages that it is environmentally friendly as it eventually degrades into citric acid and alcohol. Furthermore, acetyl triethyl citrate has a good hydrolytical stability in the composition upon storage and it is an efficient bleach activator. As used herein and unless otherwise specified, the term bleach activator includes mixtures of bleach activators.

The compositions suitable to be used according to the present invention may comprise up to 30% by weight of the total composition of said bleach activator, or mixtures thereof, preferably from 1% to 20%, and more preferably from 2% to 10%.

The pH of the liquid compositions suitable to be used according to the present invention can be from 0 to 14. In a preferred embodiment, wherein the liquid compositions herein comprise a source of active oxygen, the

recommended pH range to achieve good hydrogen peroxide stability is from 0 to 9, preferably between pH 0 and 8, more preferably between pH 0 and 7 and most preferably between 1 and 6. Accordingly, the compositions herein may further comprise an acid to adjust pH. In addition, some acids can have the advantage that they can form small concentrations of the corresponding peracids by reaction with hydrogen peroxide in-situ, thus enhancing the overall performance of the composition. These acids can be further selected so as to have chelating and/or building properties. The acids of the present invention that may be used for these purposes can be organic or inorganic acids, preferably organic acids such as citric, maleic, oxalic succinic, and tartaric acids or inorganic acids such as sulphuric acid.

The composition suitable to be used according to the present invention may comprise various optional ingredients depending on its end use as a laundry cleaning composition or as a carpet cleaning composition.

The compositions suitable to be used according to the present invention may comprise a chelating agent or mixtures thereof, as a highly preferred optional ingredient. Chelating agents suitable to be used herein include chelating agents selected from the group of phosphonate chelating agents, amino carboxylate chelating agents, polyfunctionally-substituted aromatic chelating agents, and further chelating agents like glycine, salicylic acid, aspartic acid, glutamic acid, malonic acid, or mixtures thereof.

Suitable phosphonate chelating agents to be used herein may include ethydronic acid as well as amino phosphonate compounds, including amino alkylene poly (alkylene phosphonate), alkali metal ethane 1-hydroxy diphosphonates, nitrilo trimethylene phosphonates, ethylene diamine tetra methylene phosphonates, and diethylene triamine penta methylene phosphonates. The phosphonate compounds may be present either in their acid form or as salts of different cations on some or all of their acid functionalities. Preferred phosphonate chelating agents to be used herein are diethylene triamine penta methylene phosphonates. Such phosphonate chelating agents are commercially available from Monsanto under the trade name DEQUEST®.

Polyfunctionally-substituted aromatic chelating agents may also be useful in the compositions herein. See U.S. patent 3,812,044, issued May 21, 1974, to Connor et al. Preferred compounds of this type in acid form are dihydroxydisulfobenzenes such as 1,2-dihydroxy -3,5-disulfobenzene.

A preferred biodegradable chelating agent for use herein is ethylene diamine N,N'- disuccinic acid, or alkali metal, or alkaline earth, ammonium or substitutes ammonium salts thereof or mixtures thereof. Ethylenediamine N,N'- disuccinic acids, especially the (S,S) isomer have been extensively described in US patent 4, 704, 233, November 3, 1987, to Hartman and Perkins. Ethylenediamine N,N'- disuccinic acids are, for instance, commercially available under the tradename ssEDDS® from Palmer Research Laboratories.

Suitable amino carboxylates to be used herein include ethylene diamine tetra acetates, diethylene triamine pentaacetates, diethylene triamine pentaacetate (DTPA), N- hydroxyethylethylenediamine triacetates, nitrilotriacetates, ethylenediamine tetrapropionates, triethylenetetraaminehexaacetates, ethanoldiglycines, propylene diamine tetracetic acid (PDTA) and methyl glycine di-acetic acid (MGDA), both in their acid form, or in their alkali metal, ammonium, and substituted ammonium salt forms. Particularly suitable amino carboxylates to be used herein are diethylene triamine penta acetic acid, propylene diamine tetracetic acid (PDTA) which is, for instance, commercially available from BASF under the trade name Trilon FS® and methyl glycine di-acetic acid (MGDA).

Particularly preferred chelating agents to be used herein are diethylene triamine methylene phosphonate, ethylene N,N'-disuccinic acid, diethylene triamine pentaacetate, glycine, salicylic acid, aspartic acid, glutamic acid, malonic acid or mixtures thereof and highly preferred is salicylic acid. Salicylic acid may be commercially available from Rhone-Poulenc under the name Salicylic Acid®. Indeed, it has been observed that the addition of salicylic acid on top of said amine oxide surfactants results in a synergistic effect on stain removal performance on a variety of stains including particulate stains and/or greasy/oily stains, this especially in the method of cleaning carpets according to the present invention.

The compositions suitable to be used according to the present invention comprise up to 5% by weight of the total composition of said chelating agent or mixtures thereof, preferably from 0.1% to 4% and more preferably from 0.1% to 2%.

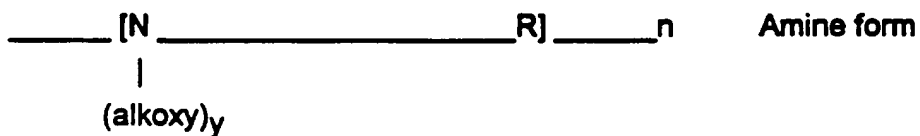
The compositions suitable to be used herein may also comprise soil suspending polycarboxylate polymers. Any soil suspending polycarboxylate polymer known to those skilled in the art can be used according to the present invention such as homo- or co-polymeric polycarboxylic acids or their salts including polyacrylates and copolymers of maleic anhydride or/and acrylic acid and the like. Indeed, such soil suspending polycarboxylate polymers can be prepared by polymerizing or copolymerizing suitable unsaturated monomers, preferably in their acid form. Unsaturated monomeric acids that can be polymerized to form suitable polymeric polycarboxylates include acrylic acid, maleic acid (or maleic anhydride), fumaric acid, itaconic acid, aconitic acid, mesaconic acid, citraconic acid and methylenemalononic acid. The presence in the polymeric polycarboxylates herein of monomeric segments, containing no carboxylate radicals such as vinylmethyl ether, styrene, ethylene, etc. is suitable provided that such segments do not constitute more than about 40% by weight.

Particularly suitable polymeric polycarboxylates to be used herein can be derived from acrylic acid. Such acrylic acid-based polymers which are useful herein are the water-soluble salts of polymerized acrylic acid. The average molecular weight of such polymers in the acid form preferably ranges from about 2,000 to 10,000, more preferably from about 4,000 to 7,000 and most preferably from about 4,000 to 5,000. Water-soluble salts of such acrylic acid polymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble polymers of this type are known materials. Use of polyacrylates of this type in detergent compositions has been disclosed, for example, in Diehl, U.S. Patent 3,308,067, issued March 7, 1967.

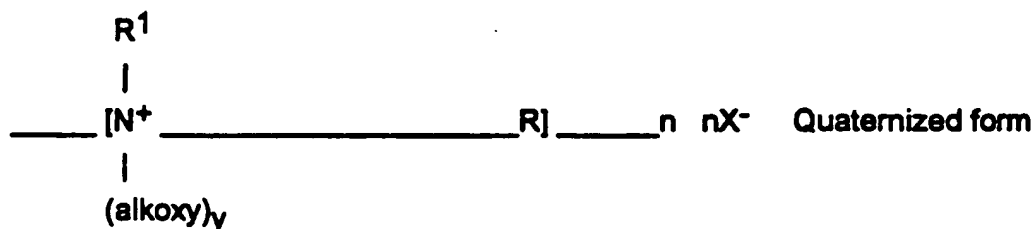
Acrylic/maleic-based copolymers may also be used as a preferred soil suspending polycarboxylic polymer. Such materials include the water-soluble salts of copolymers of acrylic acid and maleic acid. The average

molecular weight of such copolymers in the acid form preferably ranges from about 2,000 to 100,000, more preferably from about 5,000 to 75,000, most preferably from about 7,000 to 65,000. The ratio of acrylate to maleate segments in such copolymers will generally range from about 30:1 to about 1:1, more preferably from about 10:1 to 2:1. Water-soluble salts of such acrylic acid/maleic acid copolymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble acrylate/maleate copolymers of this type are known materials which are described in European Patent Application No. 66915, published December 15, 1982. Particularly preferred is a copolymer of maleic / acrylic acid with an average molecular weight of about 70,000. Such copolymers are commercially available from BASF under the trade name SOKALAN CP5.

The compositions suitable to be used herein may also comprise soil suspending polyamine polymers as optional ingredients. Any soil suspending polyamine polymer known to those skilled in the art may also be used herein. Particularly suitable polyamine polymers for use herein are polyalkoxylated polyamines. Such materials can conveniently be represented as molecules of the empirical structures with repeating units :



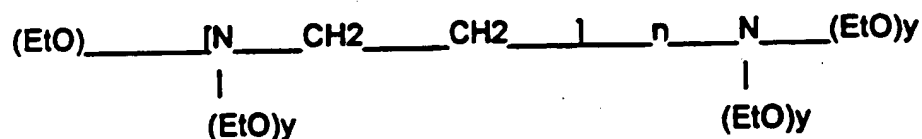
and



wherein R is a hydrocarbyl group, usually of 2-6 carbon atoms; R¹ may be a C₁-C₂₀ hydrocarbon; the alkoxy groups are ethoxy, propoxy, and the like, and y is 2-30, most preferably from 10-20; n is an integer of at least 2,

preferably from 2-20, most preferably 3-5; and X^- is an anion such as halide or methylsulfate, resulting from the quaternization reaction.

The most highly preferred polyamines for use herein are the so-called ethoxylated polyethylene amines, i.e., the polymerized reaction product of ethylene oxide with ethyleneimine, having the general formula :



when $y = 2-30$. Particularly preferred for use herein is an ethoxylated polyethylene amine, in particular ethoxylated tetraethylenepentamine, and quaternized ethoxylated hexamethylene diamine.

The compositions suitable to be used herein may further comprise other additional compounds such as other surfactants, builder system, solvents, perfumes, dyes, suds suppressing agents, enzymes, photobleaching agents, other chelating agents and other minors. In the preferred embodiment, where the compositions herein comprise a source of active oxygen, the optional ingredients are selected so that they are compatible with said source of active oxygen.

Solvents suitable for use herein may be selected from octyl alcohol, isopropyl alcohol, propyl alcohol, and/or furfuryl alcohol.

Pyrocatechol is a highly preferred optional ingredient to be used in the liquid compositions according to the present invention. The liquid compositions according to the present invention comprise up to 5% by weight of the total composition of pyrocatechol, preferably from 0.01% to 1% and more preferably from 0.01% to 0.5%.

Pyrocatechol improves the chemical stability of the liquid compositions of the present invention that further comprise a source of active oxygen, i.e. lower the decomposition of the bleach and the bleach activator if present. Indeed, it is believed that the chemical stabilising effect of pyrocatechol is twofold. Firstly they may work as radical scavengers and secondly they may

interact with the hydrogen peroxide preventing or limiting hydrolysis, therefore reducing the rate of peroxide decomposition.

Other surfactants suitable for use herein are well known in the art and include anionic, nonionic, zwitterionic and cationic surfactants and mixtures thereof. The surfactants suitable for use herein are compatible with hydrogen peroxide and sources thereof.

The anionic surfactants which may be used herein include alkali metal salts of alkyl substituted benzene sulphonates, alkali metal alkyl sulphonates, alkali metal alkyl sulphates and alkali metal alkyl ether sulphates derived from for example fatty alcohols and alkyl phenols, alkali metal alkane sulphonates, alkali metal olefin sulphonates and alkali metal sulphosuccinates and alkyl succinates, whereby the sodium salts are preferred, alkyl carboxylates and alkyl ether carboxylates.

The nonionic surfactants which may be used herein include any liquid or solid ethoxylated C₆-C₂₄ fatty alcohol nonionic surfactant, alkyl ethoxylates/propoxylates and mixtures thereof, fatty acid C₆-C₂₄ alkanolamides, C₆-C₂₀ polyethylglycol ethers, polyethylene glycol with molecular weight 1000 to 80000 and glucose amides, alkyl pyrrolidones, betaines.

Suitable cationic surfactants for use herein include quaternary ammonium compounds of the formula $R_1R_2R_3R_4N^+$ where R₁, R₂ and R₃ are methyl groups, and R₄ is a C₁₂₋₁₅ alkyl group, or where R₁ is an ethyl or hydroxy ethyl group, R₂ and R₃ are methyl groups and R₄ is a C₁₂₋₁₅ alkyl group.

Zwitterionic surfactants are also suitable optional ingredients for use herein. Suitable zwitterionic surfactants include derivatives of aliphatic quaternary ammonium, phosphonium, and sulphonium compounds in which the aliphatic moiety can be straight or branched chain and wherein one of the aliphatic substituents contains from about 8 to about 24 carbon atoms and another substituent contains, at least, an anionic water-solubilizing group. Particularly preferred zwitterionic materials are the ethoxylated ammonium sulphonates and sulfates disclosed in U.S. Patents 3,925,262, Laughlin et al., issued December 9, 1975 and 3,929,678, Laughlin et al., issued December 30, 1975. The compositions herein comprise up to 70% by

weight, preferably from 0.1% to 50% by weight of the total composition of a surfactant or mixtures thereof.

The compositions suitable to be used according to the present invention may further comprise a builder system. Any conventional builder system is suitable for use herein. Suitable builders for use herein include citric acid, preferably in the form of a water-soluble salt, derivatives of succinic acid of the formula $R-CH(COOH)CH_2(COOH)$ wherein R is C_{10-20} alkyl or alkenyl, preferably C_{12-16} , or wherein R can be substituted with hydroxyl, sulpho sulphonyl or sulphone substituents. Specific examples include lauryl succinate, myristyl succinate, palmityl succinate, 2-dodecenylsuccinate, 2-tetradecenyl succinate. Succinate builders are preferably used in the form of their water-soluble salts, including sodium, potassium, ammonium and alkanolammonium salts.

Other suitable builders are oxodisuccinates and mixtures of tartrate monosuccinic and tartrate disuccinic acid such as described in US 4,663,071.

Further suitable builders for use herein are fatty acid builders including saturated or unsaturated C_{10-18} fatty acids, as well as the corresponding soaps. Preferred saturated species have from 12 to 16 carbon atoms in the alkyl chain. The preferred unsaturated fatty acid is oleic acid.

A preferred builder system for use herein consists of a mixture of citric acid, fatty acids and succinic acid derivatives described herein above. The compositions herein may comprise from 0% to 10%, preferably from 1% to 7% by weight of the total composition of a builder system.

Examples

The following examples will illustrate the present invention. The compositions are made by combining the listed ingredients in the listed proportions (weight % unless otherwise specified).

Compositions (weight %)	I	II	III	IV
Hydrogen peroxide	6	6	7	7
Na CnAS	1	—	—	—

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MA/AA	1.0	—	—	—
DETPMP	0.2	—	—	—
PA	—	1.0	1.0	1.0
C8 Amine Oxide	1	2	2	—
C14 Amine Oxide	1	1	1	—
C10 A mine Oxide	1	—	—	3
Water and minors	<hr/> Balance <hr/>			
Sulphuric acid up to pH	5	6	6	6

DETPMP is diethylene triamine penta methylene phosphonic acid available from Monsanto under the trade name Dequest 2060 or Dequest 4060. MA/AA is copolymer of maleic/ acrylic acid, average molecular weight about 70,000. PA is an ethoxylated tetraethylenepentamine, average molecular weight about 70,000.

The carpet cleaning compositions of examples I to IV exhibit excellent stain removal performance on a variety of stains/soils including particulate stains, greasy/oily stains, bleachable stains like coffee, beverages and enzymatic stains like blood.

Composition III is preferably used in manual carpet cleaning applications in neat or diluted form. Composition I is preferably used in carpet cleaning machines. Compositions II and IV can be used for both applications, they are preferably used diluted when used in carpet cleaning machines.

The following laundry pretreater compositions further illustrate the present invention. These compositions are made by combining the listed ingredients in the listed proportions (weight % unless otherwise specified).

Compositions (weight %)	V	VI	VII	VIII	IX	X
Hydrogen peroxide	6	6	6	6	4	4
Anionic surfactants	12	12	12	12	2	4
Dobanol® 45-7	6	12	—	6	6.4	6.4
Dobanol® 23-6.5	6	—	12	6	—	—
Dobanol® 23-3	—	—	—	—	8.6	8.6
Amine oxide	1.5	0.5	1.5	3	1	3
Propandiol	3	3	3	3	—	—

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Acetyl triethy citrate	-	-	-	-	3.5	3.5
Water and minors	<hr/>					Balance

The laundry pretreater compositions V to X provide excellent stain removal performance on a variety of stains including particulate stains, greasy/oily stains, bleachable stains like coffee, beverages and enzymatic stains like blood, when used to pretreat fabrics.

What is claimed is:

1. The use of an amine oxide surfactant according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, or mixtures thereof, in a cleaning composition, to improve the stain removal performance of said composition.
2. A method of pretreating fabrics with a composition comprising an amine oxide surfactant according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, said method comprising the steps of applying said composition in its neat form onto the fabric, and allowing said composition to remain in contact with said fabric before said fabric is washed.
3. A method of cleaning a carpet to provide improved stain removal performance onto said carpet, wherein a composition comprising an amine oxide surfactant according to the formula $R_1R_2R_3NO$, wherein each of R_1 , R_2 and R_3 is independently a saturated substituted or unsubstituted, linear or branched alkyl group of from 1 to 30 carbon atoms, is applied to said carpet, wherein said carpet is then optionally rubbed and/or brushed, and wherein said composition is then removed from said carpet.
4. A method according to claim 3 wherein said composition is removed from said carpet by mechanical means including brushing out and/or vacuum cleaning.
5. A method according to claim 4 wherein said composition is a liquid aqueous composition applied neat or diluted to said carpet, or a granular composition or a powder composition which has been diluted typically with water before being applied to said carpet.
6. A method according to claim 5 wherein said neat or diluted composition after having been applied to said carpet and optionally rubbed and/or brushed, is left to dry before being removed from said carpet.

7. A method according to claims 5 or 6 wherein said composition is used in carpet cleaning machines.
8. A method according to claims 5 or 6 wherein said composition is applied to said carpet by means of a spraying device or an aerosol can.
9. A method or use according to any of the preceding claims wherein said composition comprises from 0.1% to 10% by weight of the total composition of said amine oxide surfactant or mixtures thereof, preferably from 0.5% to 6% and more preferably from 0.5% to 3%.
10. A method or use according to any of the preceding claims wherein said amine oxide surfactant is according to the formula $R_1R_2R_3NO$ wherein R_1 is a saturated linear or branched alkyl group of 1 to 30 alkyl group, preferably of 6 to 18 alkyl group, more preferably of 6 to 14, most preferably of 6 to 10, and wherein R_2 and R_3 are independently substituted or unsubstituted, linear or branched alkyl groups of from 1 to 4 carbon atoms, preferably of from 1 to 3 carbon atoms, and more preferably are methyl groups.
11. A method or use according to any of the preceding claims wherein said composition further comprises a source of active oxygen or mixtures thereof, preferably in the form of hydrogen peroxide or a source thereof and wherein said composition comprises from 0.1% to 15%, preferably from 0.5% to 10% by weight of active oxygen in said composition.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US96/03977

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : C11D 1/75; D06B 1/02

US CL : 252/ 8.8, 547

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 252/547

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS search terms: amine oxide, carpet cleaner, fabric treatment

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,671,884 (MCKINNON ET AL) 9 June 1987, Abstract; col. 2, lines 13-56; col. 3, lines 46-55; and Examples 5 and 6.	1-8
A	US, A, 4,648,882 (OSBERGHAUS ET AL) 10 March 1987, Abstract; col. 5, lines 4-17; and col. 6, lines 6-42.	1-8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X*	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y*	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*A*	document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means		
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

10 JUNE 1996

Date of mailing of the international search report

14 AUG 1996

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/03977

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 9-11
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.